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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/729,834	12/05/2003	Gary R. Holt	10006.001710	8546

31894 7590 12/08/2008
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EXAMINER	
WERNER, DAVID N	

ART UNIT	PAPER NUMBER
2621	

MAIL DATE	DELIVERY MODE
12/08/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/729,834	HOLT ET AL.
	Examiner	Art Unit
	David N. Werner	2621

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 October 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2-6 and 8-12* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-6 and 8-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on *19 July 2007* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This Office action for US Patent Application 10/729,834 is responsive to the Request for Continued Examination filed 18 October 2008, in reply to the Advisory Action of 22 September 2008 and the Final Rejection of 18 July 2008. Currently, claims 2-6 and 8-12 are pending.

2. In the Final Rejection of 18 July 2008, claims 2-4, 6, and 8-11 were rejected under 35 U.S.C. 103(a) as obvious over "Motion Compensated Enhancement of Noisy Image Sequences" (Kalivas et al.) in view of International Publication 00/64167 A1 (Prakash et al.). Claims 5 and 12 were rejected under 35 U.S.C. 103(a) as obvious over Kalivas et al. in view of Prakash et al. and in view of US 5,544,239 A (Golin et al.).

Continued Examination Under 37 CFR 1.114

3. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 18 October 2008 has been entered.

Response to Arguments

4. After reviewing the arguments presented in the Request for Continued Examination, it is believed that the Advisory Action related from a misunderstanding or misinterpretation of the arguments presented in the Request for Consideration filed 04 September 2008. Previously, it was believed that Applicant was contending against the mapping of the limitation of "adjusting weights from color blur of said segments", the "said segments" being the "arbitrarily shaped segments" of the first element. Now it is understood that Applicant faults the alleged mapping of "color blur" of "segments that are no longer adjacent" (Arguments, 18 October 2008, pg. 4). For clarification, a complete mapping will be made of claim 2, as requested.

A method for temporally filtering a video sequence, the method comprising:

Kalivas et al., sections 3.1 and 4.1, describe temporal filtering.

using object motion estimation

Kalivas et al., section 4, describes temporal filtering and spatiotemporal filtering with motion compensation.

for arbitrarily shaped segments

Kalivas et al. performs a segmentation between moving objects and a background (equation 3), and performs spatiotemporal filtering based on this segmentation (section 4). Additionally, Prakash et al., pg. 8, lines 27-34 states: "At step 204, functional block 104 of encoder 100 segments i.e. obtains the structural

information from, the reconstructed image, *the segments being used as the basis for prediction frames* in terms of the kinetics (e.g. motion and/or residue data) of the segments....Alternatively, step 203 is skipped and the encoder segments the original reference image frame from step 201" (emphasis added).

to align corresponding pixels

Kalivas et al., section 2.2, gives a motion model that "describes exactly the linear motion of the object pixels and gives a very good approximation in the case of the nonlinear motion". Pixels $\vec{r}$ at time k and $\vec{r}'$ at time k+1 are a pair of "corresponding pixels".

between at least two frames;

In Kalivas et al., the frames at time k and k+1 in a multi-frame image sequence (§5) are the "two frames".

determining segments

These are segments of an image according to the segmentation process in Prakash et al., first cited in the first element of the claim.

that are no longer adjacent to a segment boundary

In Prakash et al., a newly-exposed, or "previously hidden" region (pg. 9: lines 16-29) separates two previously adjacent regions. Prakash et al. describes processes for encoding data from previously-hidden regions as residue information, such as infilling. Interior portions of these previously-hidden regions are "no longer adjacent to a

segment boundary", or the new boundary between the previously-hidden region and another object.

based on said object motion estimation;

Coding of previously-hidden regions in Prakash et al. is made more accurate by using structural information of the segments such as boundary location (pg. 19: line 27–pg. 20: line 2) and the motion of the moving segments (column 9: line 30: column 10: line 8).

reducing impact of color blur

Kalivas et al. states that blurring of moving objects from temporal filtering and blurring of edges from spatial filtering "can be avoided or at least significantly reduced" in a spatiotemporal filter "if the motion of the moving objects and the positions of their boundaries are known" (section 4).

from said segments that are no longer adjacent

These are the previously-hidden regions in Prakash et al. in the second element. Remember that these regions are coded based on the motions and positions of boundaries of moving objects, as in Kalivas et al.

by adjusting weights assigned to one or more frames

Object indicator function $\lambda(i,j,k)$ of section 2.1 of Kalivas et al. is used in equation 3 to segregate moving objects from a background region and equation 12 to ensure that only moving objects only undergo motion compensation, with $\lambda=1$ for all pixels in moving

objects and $\lambda=0$ for all pixels in the background. Since λ is a function of time k, it is "assigned to one or more frames".

for pixels that lie within a blur region near said segment boundary;

Prakash et al. improves on Kalivas et al. by specially encoding previously-hidden regions and setting them to the background or motion as determined by a prediction (pg. 23: line 9–pg. 24: line 10). By properly determining whether a newly-exposed region is in the background or is in motion, the residue error near boundaries (column 23: line 30) is reduced, since the pixels in these regions are now more accurately assigned values of λ for the motion compensation spatiotemporal filtering of Kalivas et al.

and computing a weighted average

The spatiotemporal mean filter defined in Equation 16 of Kalivas et al., weighted via $\lambda(l,m,n)$, is a weighted average.

of color values

Conventionally, pixel values are considered to have luma (brightness) and chroma (color) values.

of said corresponding pixels.

The filters described in section 4 of Kalivas et al. account for motion compensation, and so use the "corresponding pixels".

In summary, the first element of the claim was based on Kalivas et al. The second element of the claim was based on Prakash et al. The third element of the claim was based on a combination of Kalivas et al. and Prakash et al. to improve efficiency and reduce error of the filtering system of Kalivas et al. by using the special coding techniques of Prakash et al. to determine if a previously-hidden pixel should be included in motion compensation when performing a spatiotemporal filter. The fourth element of the claim was based on Kalivas et al.

5. Applicant's arguments filed with respect to claims 4 and 11 have been fully considered but they are not persuasive. Applicant states that in MPEG, a frame "referencing" a second frame is distinct from a frame determining motion information or performing motion estimation from a second frame. With all due respect, this statement is in error, since in MPEG video, reference frames are used for motion prediction. See for example US 5,650,823 (Ngai et al.) column 5: lines 2-6: "Thus one would require three motion estimations to find a closest match for a B picture: one motion estimation with each of the two reference pictures and one motion estimation with the interpolated reference"; US 5,619,268 (Kobayashi et al.) abstract: "A motion estimation method and a motion estimation apparatus for calculating a motion vector to estimate a current picture partially forming a video sequence on the basis of first or second reference pictures partially forming the video sequence"; or US 5,585,862 (Wuertele et al.) column 1: lines 4-10: "The present invention relates to a motion estimation apparatus...for calculating a motion vector to estimate a current picture partially forming the moving

picture on the basis of a reference picture partially forming the moving picture". In an Open GOP, this motion estimation from a reference picture may be performed from a reference picture not in the present GOP, such as the first I frame of the subsequent GOP, as described in the Waggoner reference.

Claim Rejections - 35 USC § 101

6. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

7. Claims 2-6 and 8-12 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Supreme Court precedent[1] and recent Federal Circuit decisions[2] indicate that a statutory "process" under 35 U.S.C. 101 must (1) be tied to another statutory category (such as a particular apparatus), or (2) transform underlying subject matter (such as an article or material) to a different state or thing. While the instant claims recite a series of steps or acts to be performed, the claims neither transform underlying subject matter nor positively tie to another statutory category that accomplishes the claimed method steps, and therefore do not qualify as a statutory process. In the present invention, it is nowhere stated in the claims what apparatus performs the claimed method steps.

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[1] *Diamond v. Diehr*, 450 U.S. 175, 184 (1981); *Parker v. Flook*, 437 U.S. 584, 588 n.9 (1978); *Gottschalk v. Benson*, 409 U.S. 63, 70 (1972); *Cochrane v. Deener*, 94 US 780, 787-88 (1876).
[2] *In re Bilski*, 88 USPQ2d 1385 (Fed. Cir. 2008).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 2-4, 6, and 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Motion Compensated Enhancement of Noisy Image Sequences" (Kalivas et al.) in view of International Publication 00/64167 A1 (Prakash et al.), admitted as prior art in page 7: line 34–page 8: line 12 of the specification of the present invention, and cited in the Information Disclosure Statement of 18 June 2004.

Kalivas et al. teaches a noise compensation algorithm that reduces the effect of motion blur. Regarding claim 2, in Kalivas et al., a spatiotemporal filter based on motion compensation (§4.2) of an image segmented into moving objects and a static background (§2.1) is used to reduce noise (abstract). This is the claimed first element of "using object motion estimation for arbitrarily shaped segments to align corresponding pixels between at least two frames. The spatiotemporal filter reduces blur (abstract, section §4) by using a weighting system (§2.1) to ensure that only moving pixels are motion compensated (equation 16). This is a portion of the claimed third element of "reducing impact of color blur from said segments that are no longer adjacent by adjusting weights assigned to one or more frames for pixels that lie within a blur region near said segment boundary". The Spatiotemporal Mean Filter defined in

equation 16 of Kalivas et al. is the claimed "weighted average of color values of said corresponding pixels" in the fourth element of the claim.

The present invention differs from Kalivas et al. in that the present invention performs special coding on "segments that are no longer adjacent to a segment boundary based on said object motion estimation", as defined in the second element of the claim, or for especially "reducing the impact of color blur" from these segments by adjusting the weights "for pixels that lie within a blur region near said segment boundary" as specified in the third element of the claim.

Prakash et al. teaches a video motion encoder and decoder. This encoder performs segmentation of images (pg. 5: lines 27-34) into moving objects and a background, as does Kalivas et al., but Prakash et al. performs special coding of residue data from previously-hidden regions of an image that are freshly exposed due to the motion of the moving objects (page 9: lines 16-29). As shown in pages 2-3 of the 18 July 2008 Office action, these previously-hidden regions are regions "no longer adjacent to a segment boundary based on object motion estimation", and so determining these regions (page 19: line 3–page 20: line 10). This residue data may be determined as motionless "background residue" or moving "local residue", as determined by other structural information, such as the locations of boundaries and movement of moving objects in the frame (page 9: line 16–column 10: line 8). By properly determining whether this data is moving or still, the correct value of weighting function λ in Kalivas is applied, thus reducing the impact of blur from these regions, as specified in the third element of the claim.

The Kalivas reference, then, may be considered a "base" method of filtering upon which the present invention is an improvement by reducing the blur from image segments previously adjacent to segment boundaries. The Prakash et al. reference demonstrates a known technique of specially determining previously-hidden segments of an image, considered analogous or equivalent to the claimed previously-adjacent segments, and properly classifying them as background or motion objects to reduce "residue" error data. Therefore, it would have been obvious to one having ordinary skill in the art at the time the present invention was made to use the residual coding techniques of the Prakash reference before applying the motion-compensated spatiotemporal filtering of the Kalivas reference to an image with the predictable result of more accurately segmenting an image into moving and stationary components (Kalivas, §1) to reduce blur, since it has been held that to apply a known technique to a known method ready for improvement to yield predictable results involves only routine skill in the art. MPEP 2143(D); *Dann v. Johnston*, 425 U.S. 219, 189 USPQ 257 (1976); *In re Nilsen*, 851 F.2d 1401, 7 USPQ2d 1500 (Fed. Cir. 1988).

Regarding claim 3, in Kalivas et al., newly-exposed pixels determined to be "background" residue by Prakash et al. (pg. 9: lines 16-29; pg. 19: lines 8-25; pg. 23: lines 9-24) are given object indicator weight λ of 0 (§2.1).

Regarding claim 4, Kalivas et al. and Prakash et al. are silent regarding Group of Picture (GOP) structure. However, the examiner takes Official Notice that the limitation of "determining additional motion information across GOP boundaries" is a well-known

part of the MPEG standard. A GOP for which motion estimation, prediction, or compensation can be taken from a reference frame across a GOP boundary is well-known in the art as an "open GOP". It would have been obvious for one having ordinary skill in the art at the time the invention was made to include a filter on a video stream having open GOPs, since open GOPs allow for reduced bandwidth in an encoded image sequence.

Regarding claim 6, any apparatus that performs the filtration of Kalivas et al. as enhanced by Prakash et al. would perform the claimed temporal filtration as described in claim 2.

Regarding claim 8, the motion compensation of Kalivas et al. comprises the claimed steps of "estimating motion of objects" and "aligning pixels from a current frame". Calculating the spatiotemporal mean filtering in Kalivas et al. is the claimed step of "calculating a weighted average". Determining the status of residual data in Prakash et al. and updating the weighting factor of this data in Kalivas et al. is the claimed step of "adjusting weights".

Regarding claim 9, in Prakash et al., a background residue is the claimed "exposed area", and regarding claim 10, in Prakash et al., a local residue encompasses the claimed "region between converging objects".

Regarding claim 11, Kalivas et al. and Prakash et al. are silent regarding Group of Picture (GOP) structure. However, the examiner takes Official Notice that the limitation of "determining additional motion information across GOP boundaries" is a well-known part of the MPEG standard. A GOP for which motion estimation, prediction,

or compensation can be taken from a reference frame across a GOP boundary is well-known in the art as an "open GOP". It would have been obvious for one having ordinary skill in the art at the time the invention was made to include a filter on a video stream having open GOPs, since open GOPs allow for reduced bandwidth in an encoded image sequence.

10. Claims 5 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kalivas et al. in view of Prakash et al. as applied to claims 1 and 8 above, and further in view of US Patent 5,544,239 A (Golin et al.). The above-cited art do not teach adjusting a temporal filter based on a lighting offset.

Golin et al. teaches a motion estimation method that compensates for a fading image. Regarding claims 5 and 12, Figure 1 of Golin et al. shows brightness adjustment unit 104, which calculates base image 106 by reducing pixels in an image by the average pixel brightness in the image and in the next image (column 2: lines 43-53). This is in response to fade detector 101, which stores the frame in a buffer if a sequence is fading (column 2: lines 25-42). Motion analysis unit 108 then determines displacement vectors between the current image and the previous base image (column 3: lines 16-15).

Kalivas, in combination with Prakash, discloses the claimed invention except for calculating a lighting offset. Golin et al. teaches that it was known to calculate motion analysis in an image sequence based on images with adjusted brightness. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention

was made to add a brightness adjustment unit to a motion analysis system as taught by Golin et al., since Golin et al. states in column 1, lines 41-55 that such a modification would increase accuracy of motion estimation.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David N. Werner whose telephone number is (571)272-9662. The examiner can normally be reached on Monday-Friday from 10:00-6:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mehrdad Dastouri can be reached on (571) 272-7418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/D. N. W./
Examiner, Art Unit 2621

/Mehrdad Dastouri/
Supervisory Patent Examiner, Art Unit 2621